

I CLAIM:

1. Apparatus to heat a bitumen froth by steam comprising:
 - i. a source of steam;
 - 5 ii. an inline heater body forming a bitumen inlet, a steam inlet in communication with the source of steam and a mixture outlet all in common communication with each other;
 - iii. a baffle disposed across the mixture outlet; and
 - iv. an elongate static mixer body forming a passageway therethrough,
 - 10 one end of the passageway in communication with the mixture outlet, the body supporting a plurality of baffles disposed to effect a mixing action of material flowing through the passageway thereof.
2. The apparatus of claim 1 wherein the baffles are disposed within the static
15 mixer body to impart a lateral, radial, tangential or circumferential directional component to a material flow through said static mixer passageway that changes repeatedly along the length of the passageway.
3. The apparatus of claim 1 further including a steam flow control valve to
20 control the rate of steam supply to the steam inlet.
4. The apparatus of claim 3 further including a temperature transmitter disposed to measure the temperature of material flowing through the passageway of the static mixer forming a closed loop control system of the steam
25 flow control valve responsive to the measured temperature.
5. The apparatus of claim 1 further including a steam flow pressure control valve to control the pressure of steam supply to the steam inlet from the steam source.
- 30 6. The apparatus of claim 5 further including a pressure transmitter disposed to measure the pressure of steam supply from the pressure control valve forming

a closed loop control system of the steam flow pressure control valve to maintain the pressure of the steam supplied to the steam inlet.

7. The apparatus of claim 1 further including:

- 5 i. a condensate source;
- ii. means to mix the condensate with steam from the steam source;
- and
- iii. a condensate flow control valve to control the supply of condensate to the mixing means.

10

8. The apparatus of claim 7 further including a temperature transmitter disposed to measure the temperature of steam supply to the steam inlet forming a closed loop control system of the condensate flow control valve to control the supply of condensate to the steam supply to the steam inlet responsive to the

15 measured temperature.

9. Apparatus to heat a bitumen froth by steam comprising:

- i. a source of steam;
- ii. an inline heater body forming a bitumen inlet, a steam inlet in
- 20 communication with the source of steam and a mixture outlet all in common communication with each other;
- iii. a steam pressure flow control valve to control the pressure of steam supply to the steam inlet from the steam source;
- iv. a condensate source;
- 25 v. means to mix the condensate with steam from the steam source;
- vi. a condensate flow control valve to control the supply of condensate to the mixing means;
- vii. a steam flow control valve to control the rate of steam supply to the steam inlet from the steam source;
- 30 viii. a baffle disposed across the mixture outlet; and
- ix. an elongate static mixer body forming a passage therethrough, one end of the passage in communication with the mixture outlet, the body supporting

a plurality of baffles disposed to effect a mixing action of material flowing through the static mixer.

10. The apparatus of claim 9 wherein the baffles are disposed within the static mixer body to impart a lateral, radial, tangential or circumferential directional component to a material flow through said passage that changes repeatedly along the length of the static mixer passage.

11. The apparatus of claim 9 further including a temperature transmitter disposed to measure the temperature of material flowing through the passage of the static mixer proximal to the end of the passage remote from the end in communication with the mixture outlet forming a closed loop control system with the steam flow control valve to control the supply of steam to the material to obtain a target output temperature of the material flow leaving the static mixer.

15

12. The apparatus of claim 9 further including a pressure transmitter disposed to measure the pressure of steam supply to the steam inlet from the steam source forming a closed loop control system of the steam pressure flow control valve to control the supply of steam to the steam inlet responsive to the measured pressure.

20

13. The apparatus of claim 9 further including a temperature transmitter disposed to measure the temperature of steam supply to the steam inlet forming a closed loop control system of the condensate flow control valve to control the supply of condensate to the mixing means responsive to the measured temperature.

25

14. A method to heat a bitumen froth by steam comprising:

- i. providing a source of steam;
- ii. contacting the steam with a bitumen froth flow within an inline heater body;
- iii. mixing the steam and bitumen froth flow to obtain a uniform temperature of the mixture material flow.

30

15. The method of claim 14 further including the step of controlling the rate of steam supply of the steam contacting the bitumen froth to control the uniform temperature of the mixture material obtained in the mixing step.

- 5 16. The method of claim 15 further including the steps of:
- i. measuring the uniform temperature of the mixture material flow; and
 - ii. varying the rate of steam supply of the steam contacting the bitumen froth flow to obtain a target uniform temperature of the mixture material flow.

10

17. The method of claim 14 further including the step of controlling the pressure of the steam supply of the steam contacting the bitumen froth.

18. The method of claim 17 further including the steps of:

- 15
- i. measuring the controlled pressure of the steam supply; and
 - ii. varying the rate of the steam supply to obtain a target pressure of the steam contacting the bitumen froth.

19. The method of claim 14 further including the step of providing a

20 condensate to the steam supply to control the temperature the steam contacting the bitumen froth.

20. The method of claim 19 further including the steps of:

- 25
- i. measuring the controlled temperature of the steam supply contacting the bitumen froth; and
 - ii. varying the rate of providing condensate to the steam supply to obtain a target temperature of the steam contacting the bitumen froth.

21. A method to heat a bitumen froth by steam comprising:

- 30
- i. providing a source of steam;
 - ii. controlling the pressure of the steam;
 - iii. controlling the temperature of the steam;
 - iv. controlling the rate of supply of the steam;

v. contacting the steam with a bitumen froth flow within an inline heater body; and

vi. mixing the steam and bitumen froth flow to obtain a uniform temperature of the mixture material flow.

5

22. The method of claim 21 further including the steps of:

i. measuring the uniform temperature of the mixture material flow; and

ii. varying the rate of steam supply of the steam contacting the bitumen froth flow responsive to the measured temperature.

10

23. The method of claim 21 further including the steps of:

i. measuring the controlled pressure of the steam supply; and

ii. varying the rate of the steam supply responsive to the measured pressure.

15

24. The method of claim 21 further including the steps of:

i. measuring the controlled temperature of the steam supply contacting the bitumen froth; and

ii. varying the rate of providing condensate to the steam supply responsive to the measured temperature.

20